# INVERTING AND NON-INVERTING AMPLIFIER USING OP-AMP

## AIM:

1) Design an Inverting and Non Inverting Amplifier using Op Amp using F/B network.
2) Determine the Bandwidth of Amplifier using AC analysis.
3) Evaluate the open loop gain, loop gain and close loop gain of both the amplifier (*VFB/VTEST*) and do AC analysis.
4) Comment on the stability of the Feedback Amplifier.

## APPARATUS REQUIRED:

LTSpice Software.

## THEORY:

An inverting amplifier (also known as an inverting operational amplifier or an inverting op-amp) is a type of operational amplifier circuit which produces an output which is out of phase with respect to its input by 180°. The voltage gain of the inverting amplifier is,

$$A_v = \frac{-Rf}{R1}$$

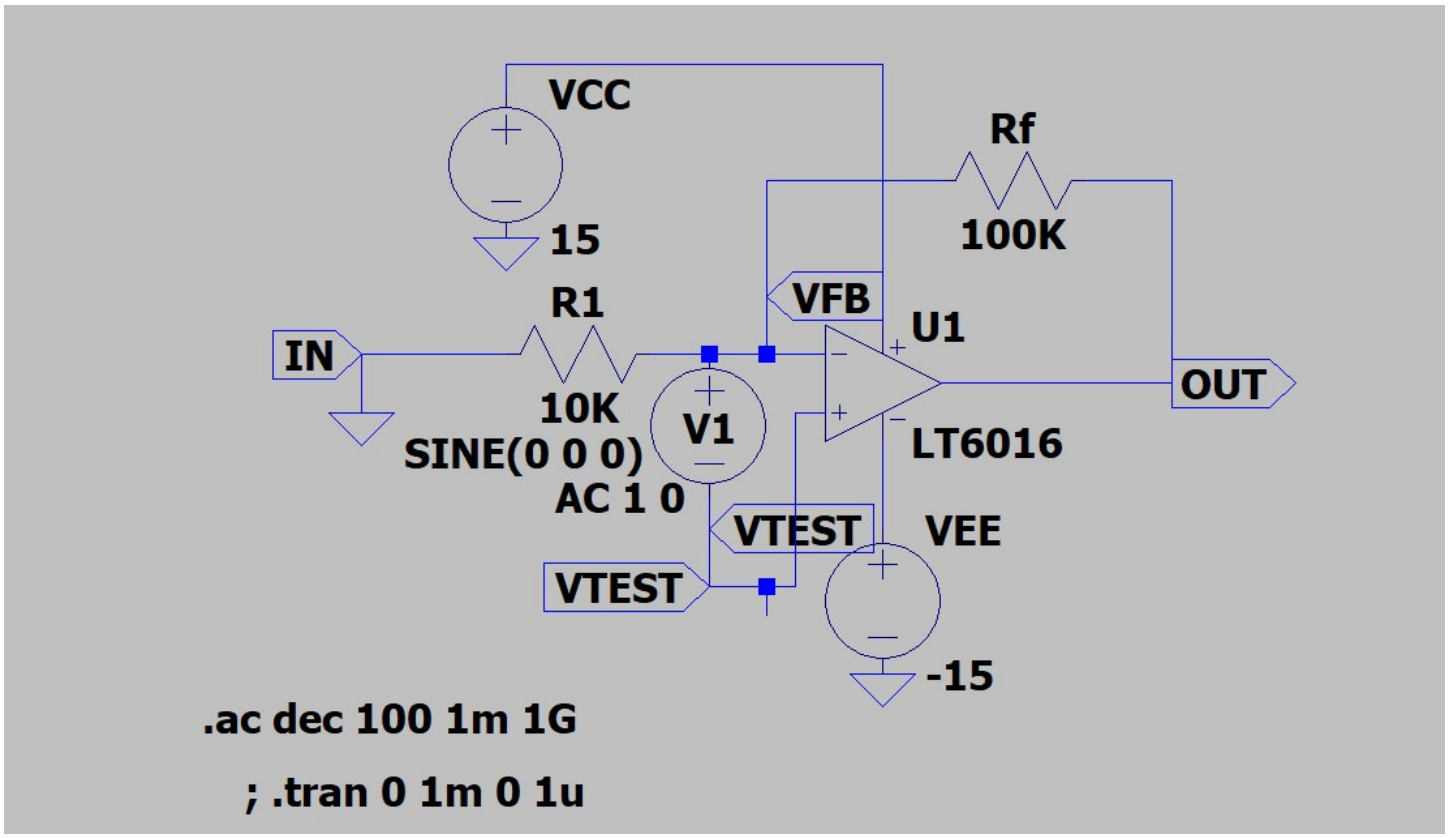
Feedback control of the non-inverting operational amplifier is achieved by applying a small part of the output voltage signal back to the inverting ( – ) input terminal via a Rf – R2 voltage divider network, again producing negative feedback. This closed-loop configuration produces a non-inverting amplifier circuit with very good stability, a very high input impedance, Rin approaching infinity, as no current flows into the positive input terminal, (ideal conditions) and a low output impedance. The voltage gain of the non inverting amplifier is,

$$A_v = 1 + \frac{Rf}{R1}$$

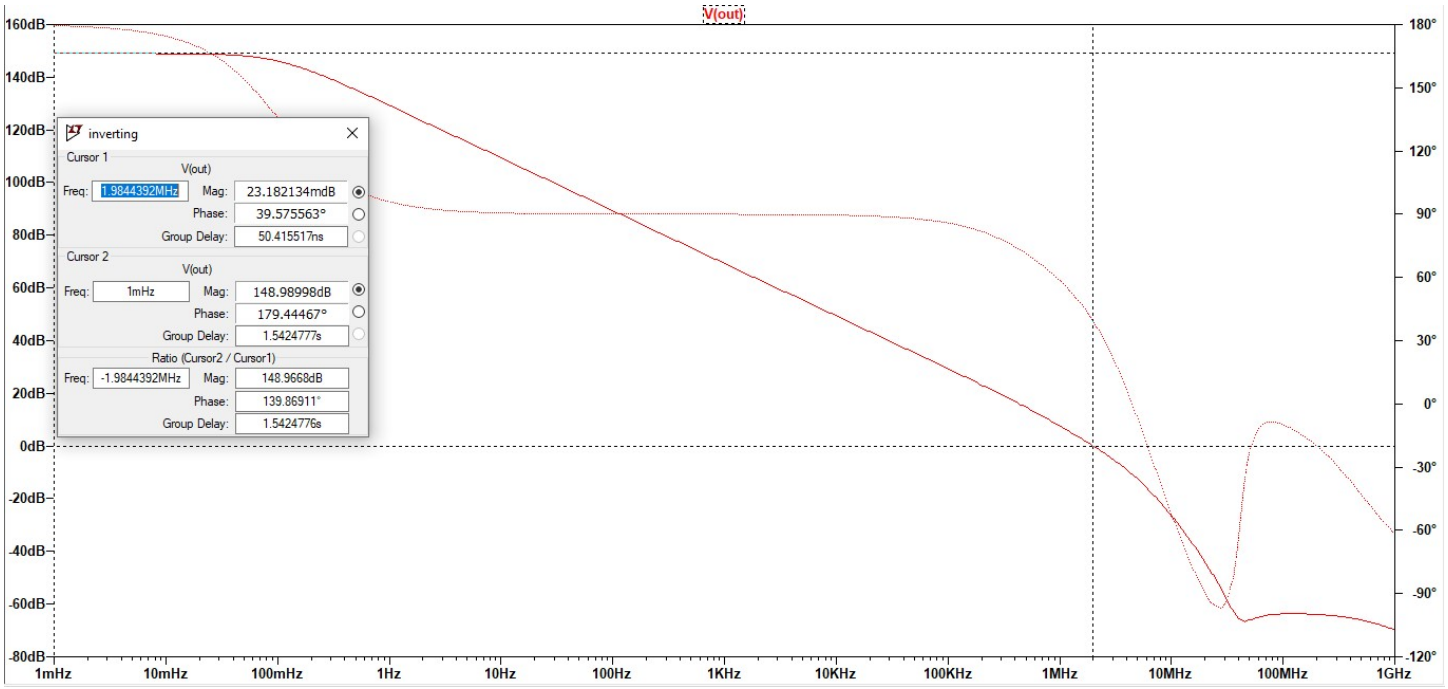
INVERTING AMPLIFIER:

OPEN LOOP

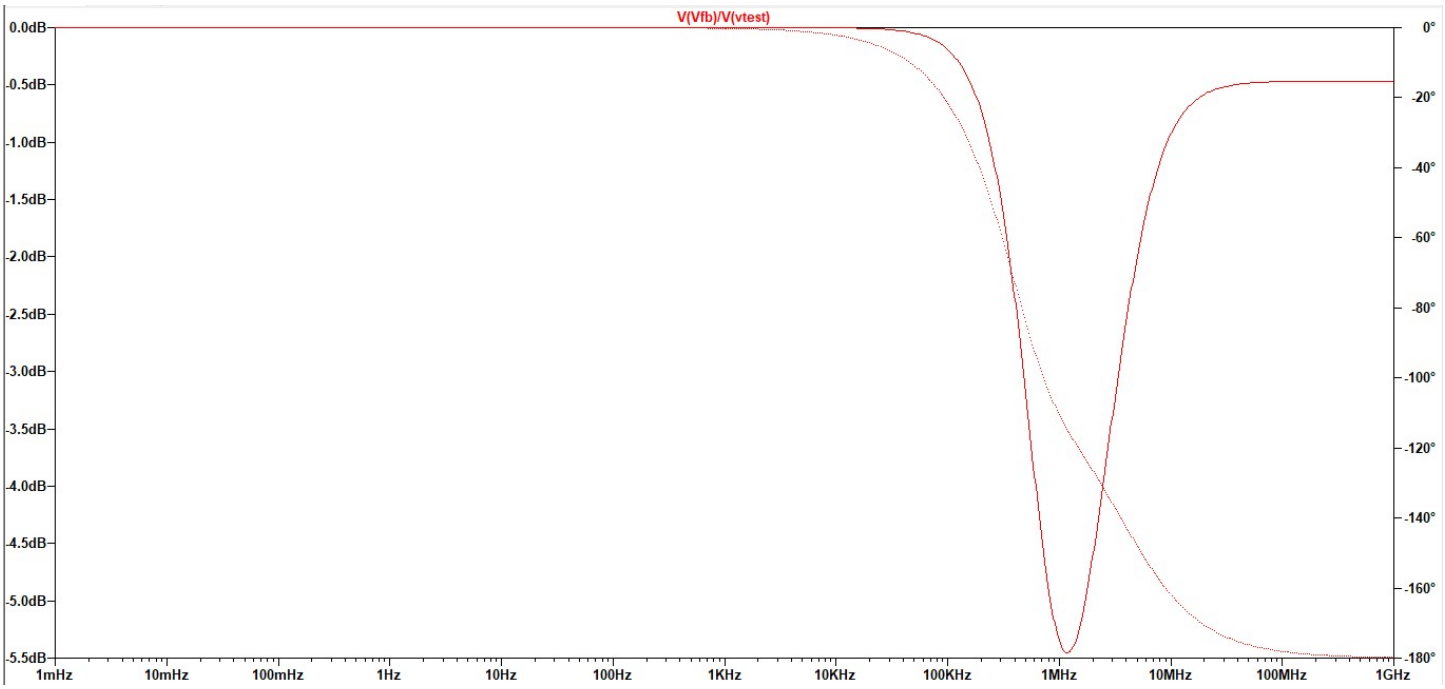
CIRCUIT:




OUTPUT:

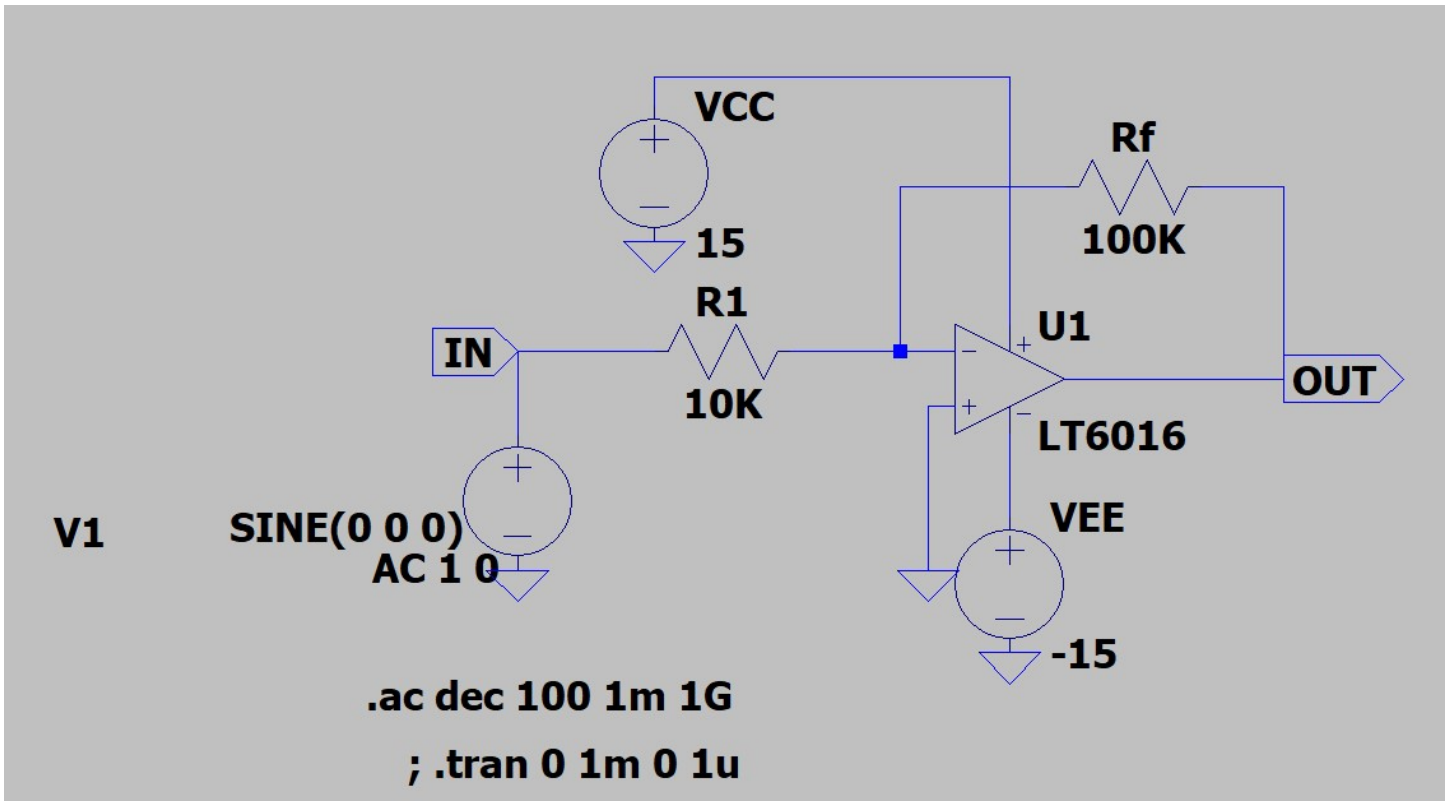


$V_{fb}$ / $V_{Test}$

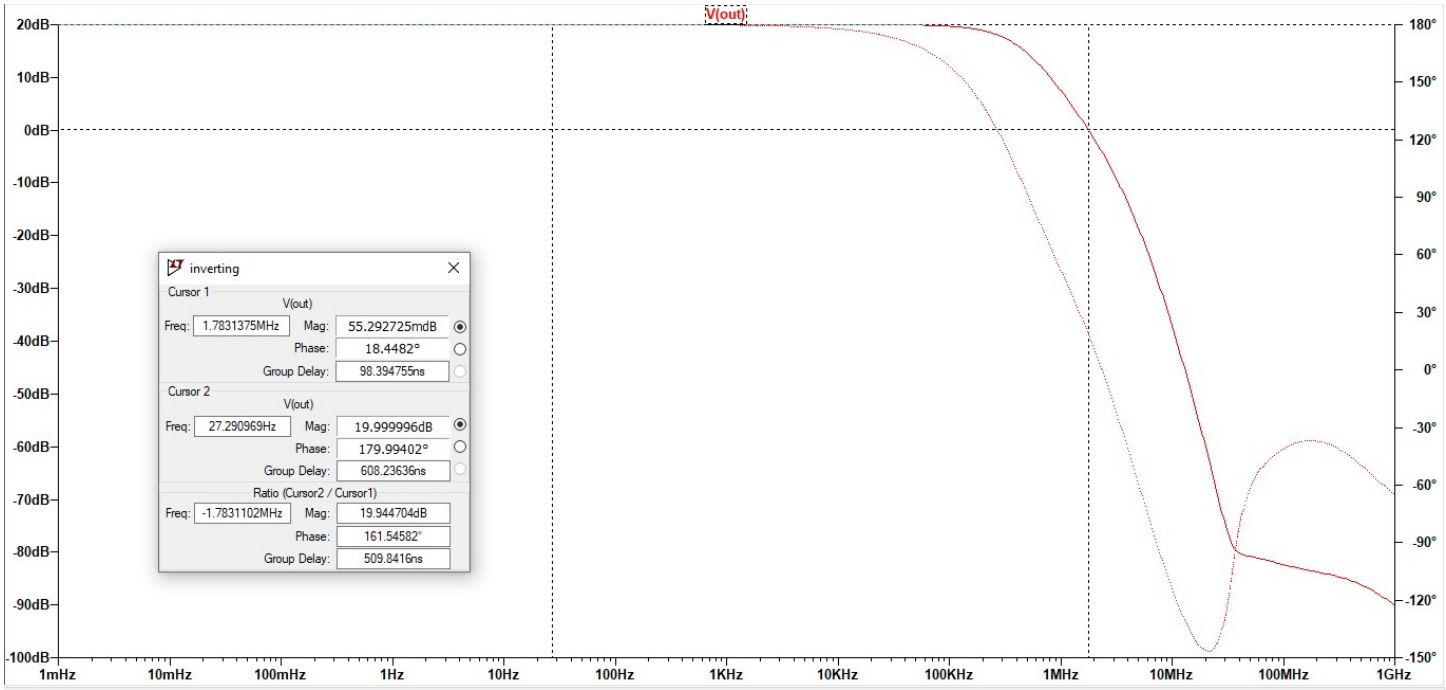



CLOSED LOOP:

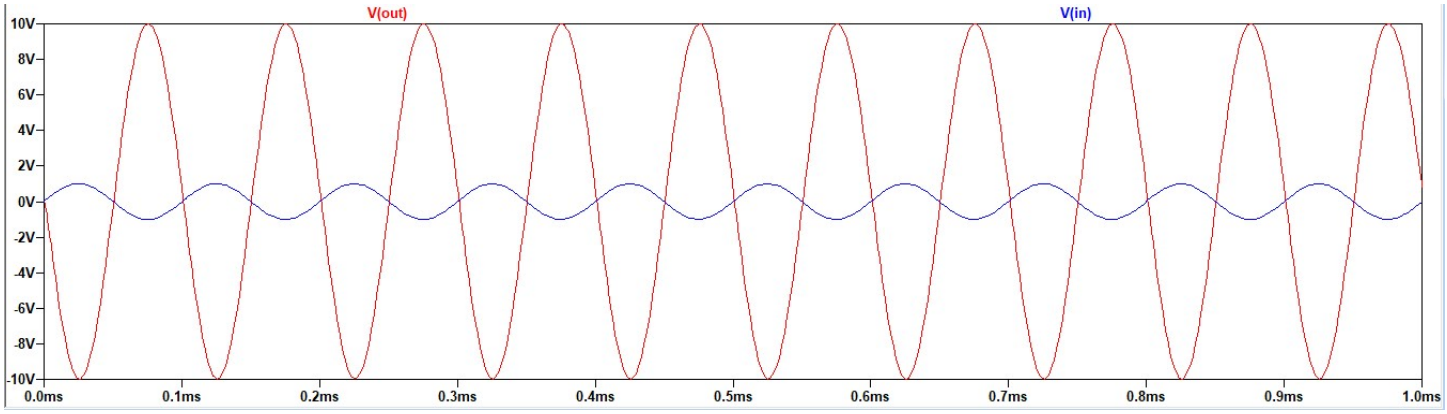
CIRCUIT:



OUTPUT:




TRANSIENT:




## Observation:

Open loop: Wgc = 1.984MHz. The phase doesn’t cross -180 degrees so the system is stable.

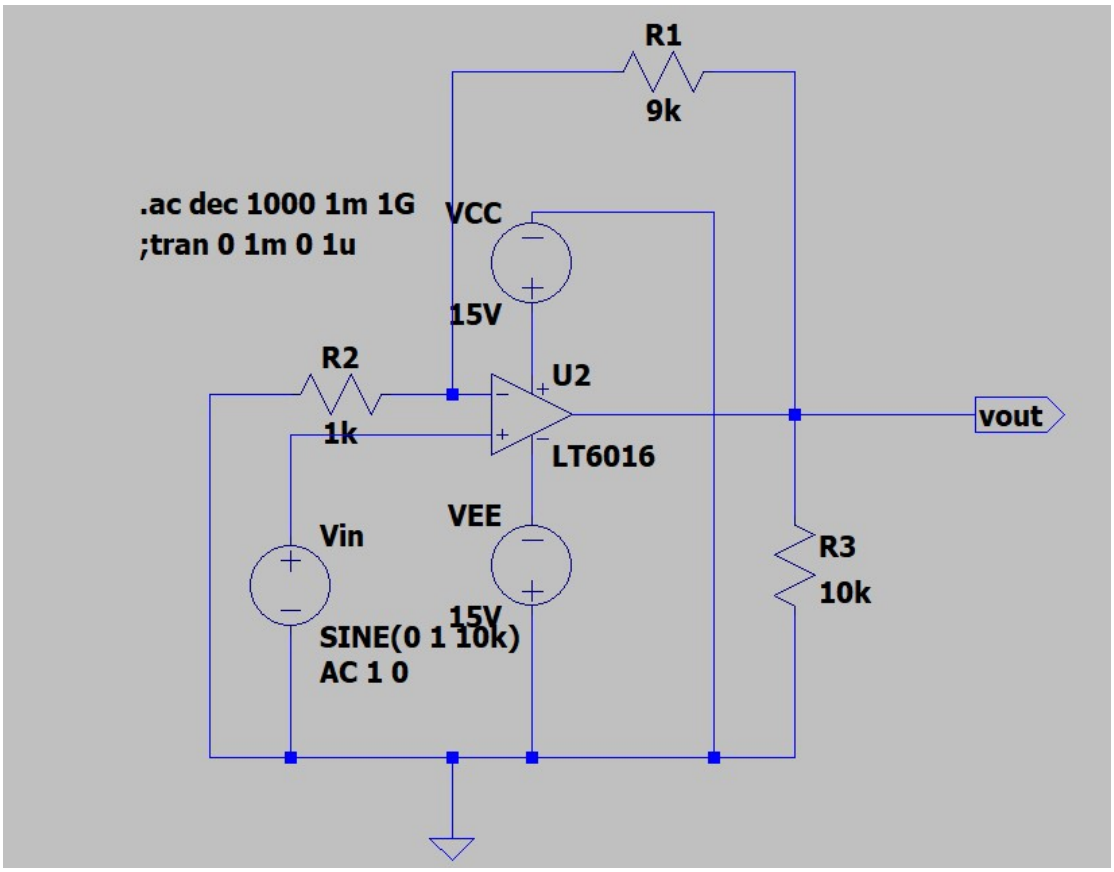
Closed loop: Wgc = 1.784MHz. The phase doesn’t cross -180 degrees so the system is stable.

Closed loop gain = 10

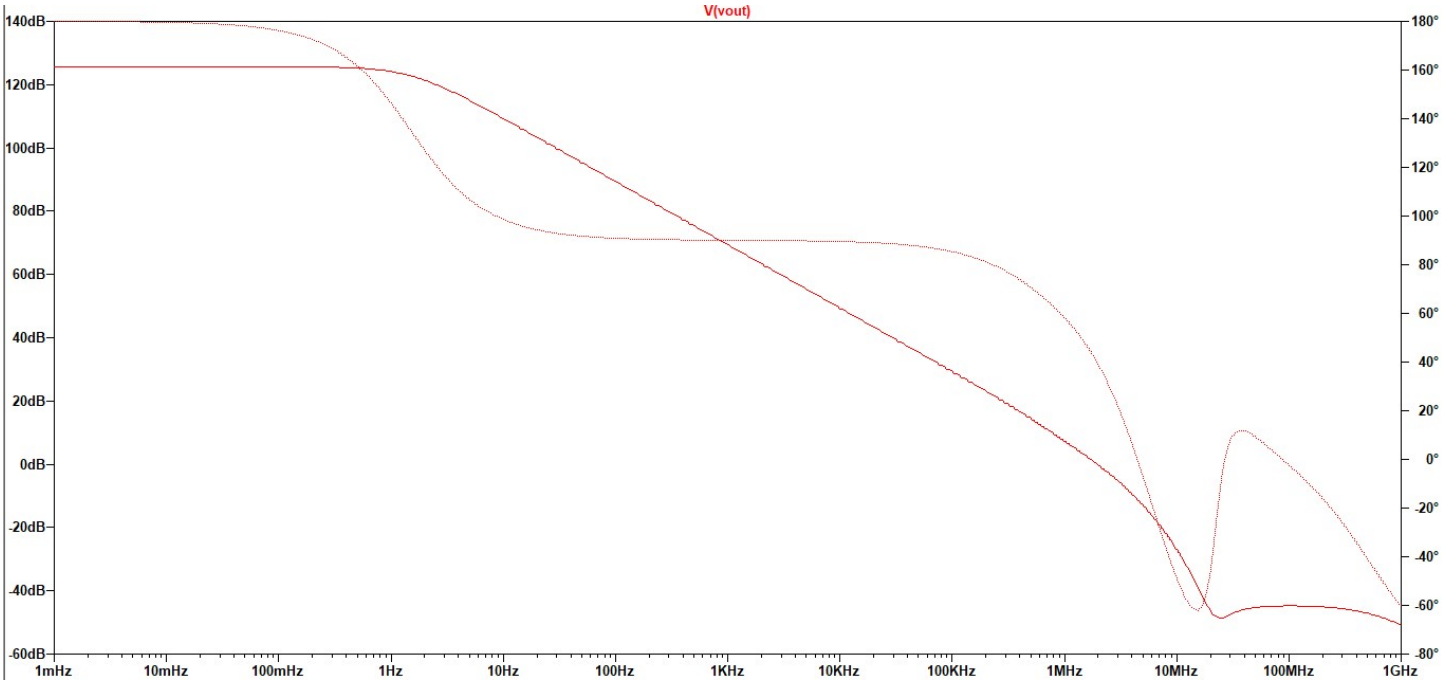
NON INVERTING AMPLIFIER:

OPEN LOOP

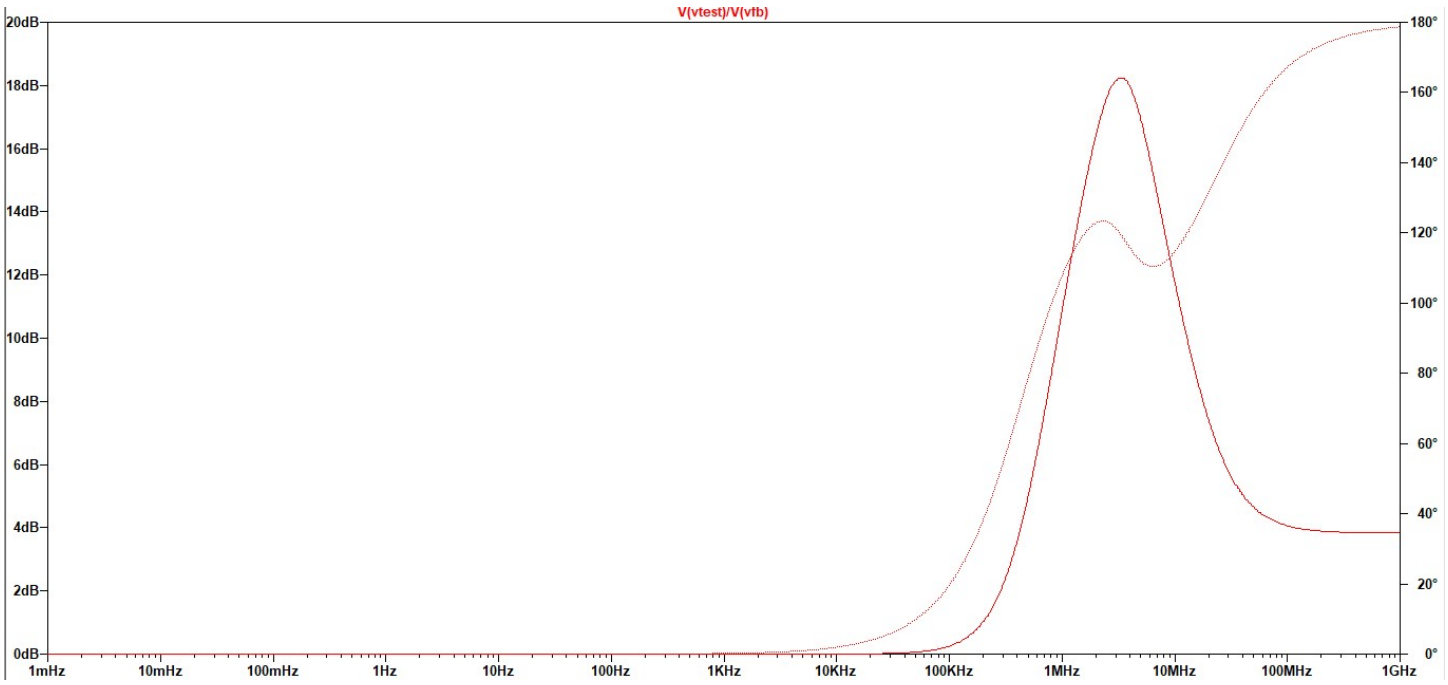
CIRCUIT:




OUTPUT:

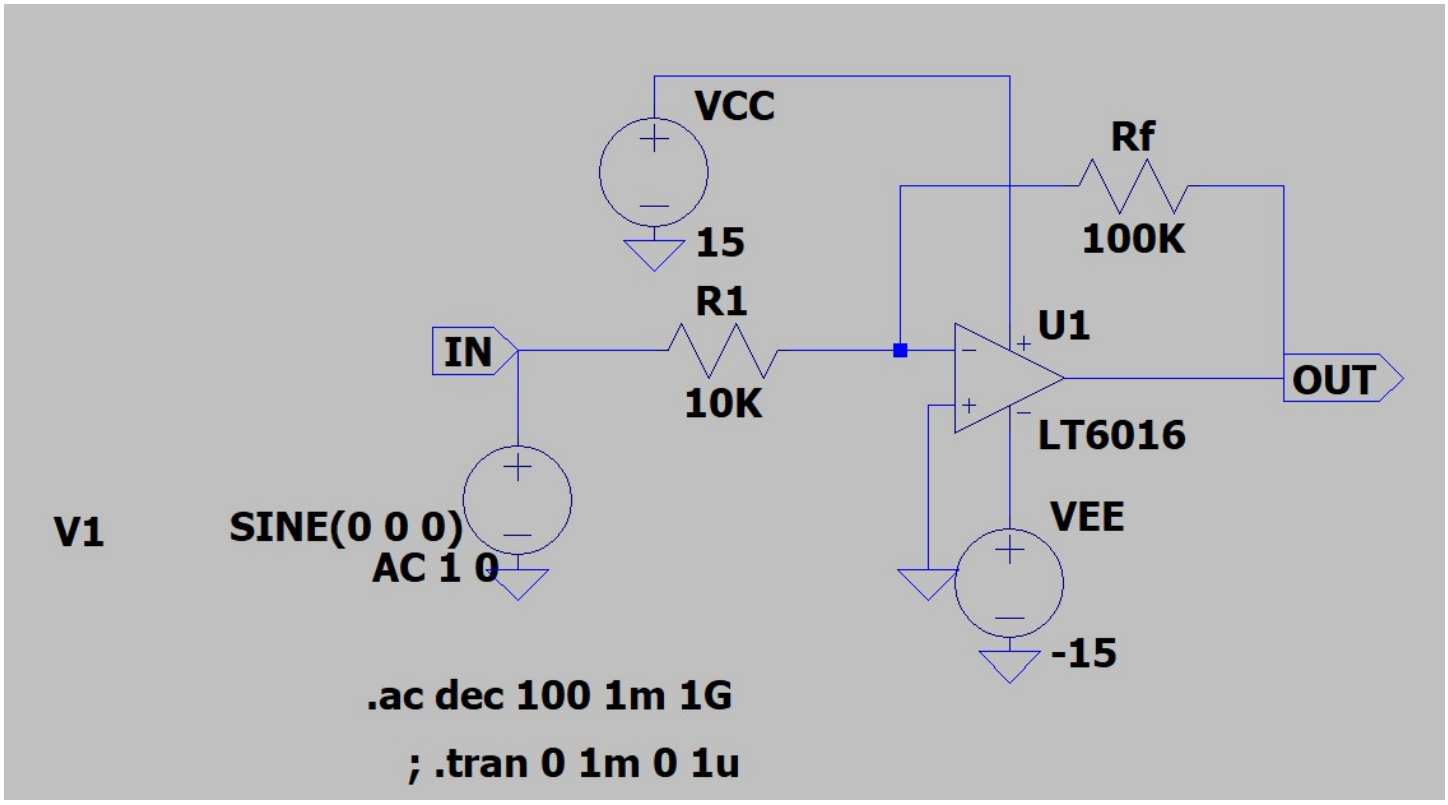


$V_{fb}$ / $V_{Test}$

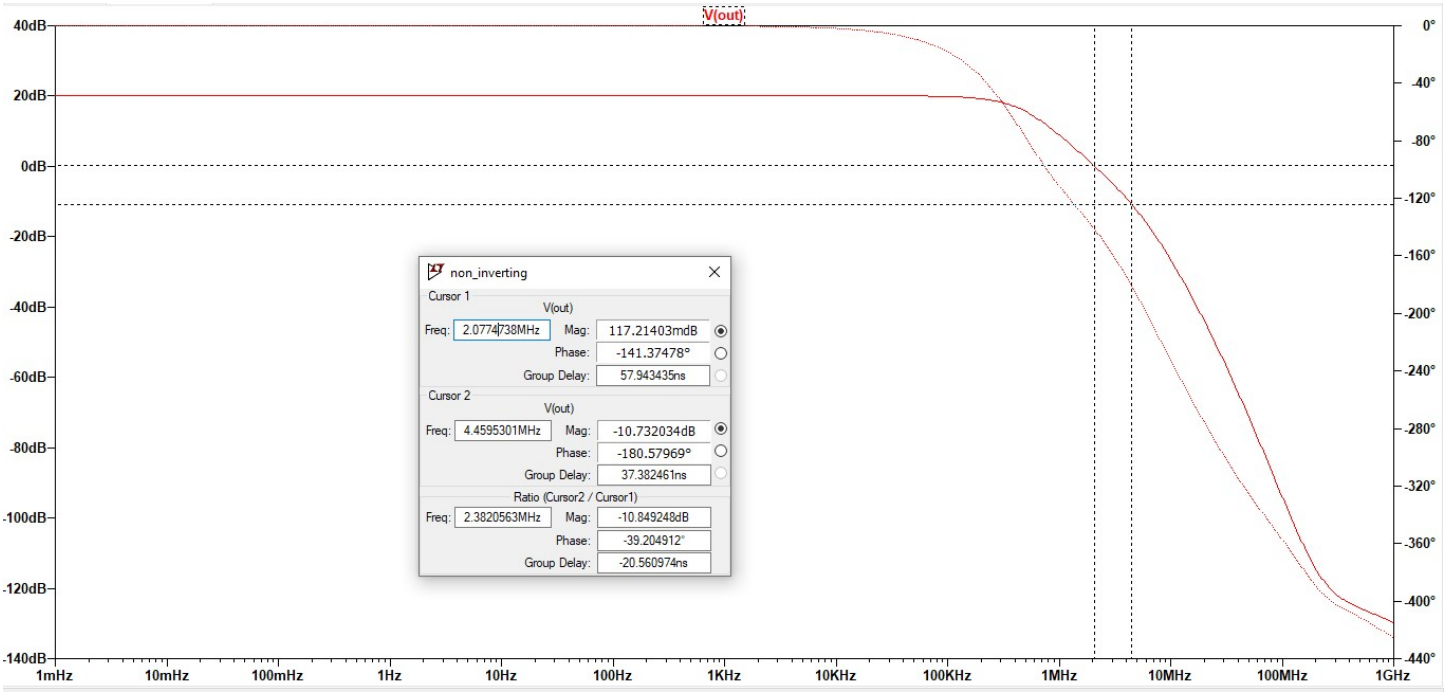



CLOSED LOOP:

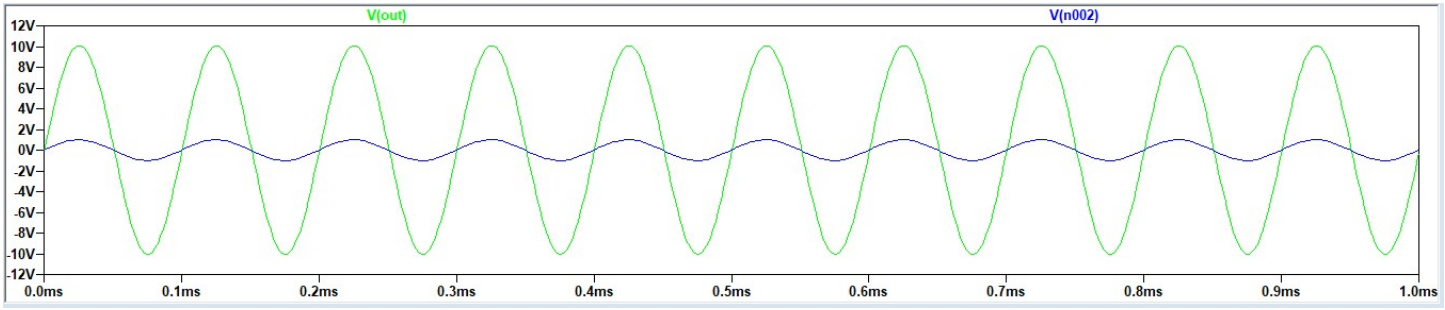
CIRCUIT:



OUTPUT:




TRANSIENT:




Observation:

Open loop: Open loop: Wgc = 1.984MHz. The phase doesn't cross -180 degrees so the system is stable.

Closed loop: Wgc = 2.07 MHz, Wpc = 4.45 MHz. Wgc < Wpc, so the system is stable.

Phase Margin = -39.2 degrees Gain Margin = 10dB

Closed loop gain = 10

**Result:**

The Experiment has been performed with both configuration of OpAmp and found to be correct.